1997

An Analysis of Critical Thinking at a Liberal Arts College

Amy Goebel

An Analysis of Critical Thinking at a Liberal Arts College

A THESIS

The Honors Program

College of Saint Benedict/Saint John's University

In Partical Fulfillmant

of the Requirement for the Distinction

and the degree Bachelor of Arts

in the Department of Psychology

by

Amy Goebel

May 1997

An Analysis of Critical Thinking at a Liberal Arts College

Approved by:

Associate Professor of Psychology

Assistant Professor of Psychology

Associate Professor of Nursing

Chair, Department of Psychology

Director, Honors Thesis Program

Director, Honors Program

Abstract

This study investigated the differences among first-year, sophomore, junior, and senior college students in critical thinking skills and dispositions as measured by the California Critical Thinking Skills Test and the California Critical Thinking Dispositions Inventory. Tests were administered to college students from a small, private institution in a rural area of the Midwest enrolled in general education courses with a majority being first-year and senior students. Consistent with the hypothesis, critical thinking skills and dispositions differed significantly between first-year, sophomore, junior, and senior students. Scores on the two tests were significantly correlated with each other, and scores on the skills test and the dispositions inventory were both significantly correlated with cumulative GPA. The results indicate that critical thinking skills and dispositions grow as a function of progress through general education courses in the liberal arts. In some way throughout the college years, critical thinking skills and dispositions are enhanced in students.

An Analysis of Critical Thinking at a Liberal Arts College

> Liberal education is about learning to learn, to think for yourself, on your own and in collaboration with others. Liberal education leads us away from naive acceptance of authority, above self-defeating relativism, beyond ambiguous contextualism. It culminates in principled reflective judgement. Learning critical thinking, cultivating the critical spirit, is not just a means to this end, it is part of the goal itself. People who are poor critical thinkers . . . cannot be said to be liberally educated, regardless of the academic degrees they hold. Critical thinking is a liberating force in education and a powerful resource in one's personal and civic life. . . .Critical thinking is a pervasive and self-rectifying human phenomenon. (Facione, 1996, p.10)

Looking back on my years in college, I realize that my favorite professors were those who sent me out of the classroom pondering issues, relating them to my life, and wanting to learn more about them. They encouraged me to figure things out for myself, to go beyond factual information, and to articulate high quality answers to complex questions. Not only did I gain valuable skills that I knew I could take with me out of the classroom, I realized that other influences such as the Benedictine tradition and student development activities could have the same impact. Now I am able to put a label on what my experience at the College of Saint Benedict and Saint John's University helped me to achieve: a love of learning and a capacity for critical thinking.

I have always been intrigued by ambiguous and ambitious constructs such as critical thinking. The value I place on critical thinking drew me to find out more about it. As I look back on my college education I wonder how one knows who has "gotten it" and who has not. How do we measure such ambiguous constructs? Are there differences in the lives of individuals who 'got it' and those who did not? I knew that I was responsible for my education, but I also wondered if anyone else was. If so, were they responsible for anything beyond giving grades?

Although I perceived that I had gained critical thinking skills, I still wondered if I really had it and how I could know.

Critical thinking is regarded as invaluable to excellence in work, personal life, and society. George Klemp studied the characteristics, skills, and abilities required for effective work. He identified successful individuals in a variety of occupations and professional roles, found out what they did that made them successful, and examined how and why they were successful. Through observation, interviews, and direct assessment, he found that the amount of content area knowledge one acquires is generally unrelated to superior performance in an occupation. Even though a minimum level of knowledge in a field is necessary for execution of work related duties, this was not the most important thing. He found that superior performance was associated with an employee's willingness and ability to learn new things. In fact, it was not the acquisition of specific knowledge nor the use of that knowledge that distinguished the outstanding performer, but it was the possession of *cognitive skills* that were developed and exercised in the process of acquiring and using knowledge. These cognitive skills included information processing skills, conceptualizing skills, the ability to understand many sides of a controversial issue, and the ability to learn from experience (as cited in Chickering, p. 22, 1980).

Due to the increasing amount and complexity of information available to the individual, critical thinking continues to gain attention and relevance because it helps people to weigh options, and to objectively assess what is best in specific situations. Since World War II, the service sector has grown dramatically and so has the way that technology affects our lives. This has led to a shift from production workers to knowledge and service workers. Goods producing industries such as agriculture are down from 7.6 million workers to 3.5 million workers, while

management, health, science and engineering fields are booming. Being able to think critically will give an individual the edge needed in the workforce today.

The key to effective service is quality. The need for high quality as opposed to quantity gives critical thinking more value today than ever (Ginsberg, 1976). For example, it easy to produce lots of computer programs, but it is much more difficult to produce the best computer program in relation to what people need. Due to the greater difficulty in producing quality services, we are moving from the specialist who is soon obsolete to the generalist who can adapt (Naisbitt, 1990). Leaders in a complex, pluralistic society require not only technical or professional expertise, but the ability to make consequential judgments on issues involving the contextual understanding and assessment of multifaceted problems. The free mind thrives on the world of experiences with all of its contradictions, ambiguities, and paradoxes. The free person deals with uncertainty in a sure way and has the capability to make future decisions based on the present and the past (Callander, 1986). Environmental turbulence and high degrees of interdependence create dilemmas and paradoxes for organizations which make critical thinking a key characteristic of effective leadership processes (Novelli & Taylor, 1993).

Not only are we presented with complex and ambiguous situations at work, but in everyday life. Critical thinking is about connecting learning with life (Regelski, 1976). Critical thinking is an invaluable tool for success in one's personal life because it helps people to make wise choices. It allows people to continuously engage in a process of self discovery, and to live a life of responsibility. It helps people to organize complexity, to deal with less than perfect situations, to face problems, and to resist easy answers. Critical thinking is about persistently seeking the truth in all situations of life. Tolerance of delayed reinforcement, patience, and the

ability to finish tasks are also part of critical thinking (Chafee, 1992). It enables one to make good decisions. This skill could overflow into a good family life, to a great career, and to a happy individual outlook.

In democratic societies, a curiosity about the truth, and a habit of asking the right questions is necessary in order that all individuals can make well informed decisions. Good critical thinkers within society project consequences of decisions in a committment to larger social goals. People are needed who will consider facts, who will consider the pros and cons of an issue, and who will leave their personal biases out as much as possible. A good critical thinker would also recognize his/her biases and try to balance them with other views. If people were not able to attend to evidence, analyze and interpret trends, to predict and evaluate the implications of a decision before it is made, or explain the potential impact of a decision on a group of people or a budget, our social systems would disintegrate. We have a stronger need than ever to enhance critical thinking in society. People need the intellectual tools to deal with information, to manage it, and make intelligent judgments with it. We need people with a breadth of experience and knowledge such that they can use the massive amount of available information and the advanced intellectual tools in order to analyze business, political or social environments and make sound judgments that will benefit the individual, the organization, and society.

Critical thinking is directly linked to undergraduate education. Effective and meaningful education requires that curricular, pedagogical, and assessment strategies at all levels of education be coordinated to foster cognitive skills and habits of inquiry known as "critical thinking" (Facione, 1990). The basic intellectual competencies necessary for an executive role in

our increasingly information-based society are nowhere better developed than by the liberal arts and sciences (Brown, 1994). Educators have long known that learning to learn was crucial for students' professional and personal success. Joining the consensus, employers, business leaders, policy-makers, accrediting agencies, and professional associations have identified critical thinking as an essential college level educational outcome. Promoters of liberal education know that the process of inquiry, learning thinking rather than the accumulation of disjointed skills and senescent information is the most important educational outcome. The heart of education is where traditional advocates of liberal education always thought it was (Facione, 1990). Critical thinking is a skill that all college educated individuals should develop.

The liberal arts, or general education as it is sometimes called, promise more than memorization of facts, knowledge of a discipline, or training for a job. Critical thinking in the liberal arts context dates back to the European origins of the university in Plato's Academy in that education should address the whole person (Brown, 1994). They addressed the whole person through the "liberal arts." Liberal arts institutions promise to not only train students for jobs, but to train them for life by fostering a love of learning, personal initiative, and personal responsibility. The liberal arts promise more than a technical education. Something extra is guaranteed by the liberal arts that hopefully separates the excellent from the mediocre. This is not to say people who do not go to college cannot be good critical thinkers, but that critical thinking is strongly connected to college education. The liberal arts promise to enhance students' critical thinking skills and the dispositions to use those skills. According to Brown (1994), only education in the liberal arts reliably offers this possibility of constructively transcending the cultural myopia of most practices, including the tunnel vision of training in the professions (p.

44).

The Goals of the College of Saint Benedict and Saint John's University

The learning goals and objectives of the College of Saint Benedict and Saint John's University, a pair of coordinate liberal arts institutions, include the development of critical thinking skills within the liberal arts oriented education they offer. The second of their institutional Learning Goals states, "Graduates will be able to integrate knowledge from the liberal arts and sciences as they explore the human condition . . . and will be able to make defensible ethical and moral decisions" (Assessment Plan, 1994, p. 21). Goal 4 states, "Graduates will be able to apply clear thinking and communication skills to the exploration of fundamental questions of the human condition and will be able to critically analyze information from a variety of sources to make defensible judgements" (Assessment Plan, 1994, p. 22). Highly related is Goal 5 which states, "Graduates will be able to establish patterns of life long learning to seek and integrate knowledge of self and the world" (Assessment Plan, 1994, p.22). Thus, it is clear that critical thinking is central to the goals of these liberal arts institutions.

Often, with liberal arts institutions, there is not one class, teacher, or development activity responsible for teaching or encouraging critical thinking. It can be difficult to measure critical thinking because critical thinking can happen in the classroom, during student development activities, or at any time throughout the undergraduate years. In other words, critical thinking may not be explicitly and systematically taught throughout the curriculum. At the College of Saint Benedict and Saint John's University, there is not a critical thinking general education requirement, but there are specific general education classes required of all first year students and

specific general education classes required of all senior students that have a critical thinking component. These two classes in particular are seen as beginning and ending points, respectively, of an individual's college education. The goals of the senior general education requirement labeled, "Senior Seminar" support the college intention to add to students' ability to think critically. The goals of the "Senior Seminar" class support the idea that critical thinking should be enhanced as a result of a college education at two particular institutions. The original intentions of the Senior Seminar program recognize that:

> " . . . it is the mark of an educated person not to expect more precision from a given line of inquiry than it can by its nature yield (p. 4). The traditions of the liberal arts and the Benedictine character of our two colleges emphasize the need to develop in our students an ability to lead responsible lives in a contemporary world. This concern has always been a central element in notions about striving for a 'good life,' leading a life of civic responsibility, a life of personal integration, a life of 'wholeness.' At the junior/senior level of the curriculum, this objective implies that explicit and focused attention be paid to developing the ability to make good moral judgements on issues that affect our lives . . . By "good moral judgments" we understand choices which are consciously elected and defensibly maintained. The Senior Seminar program goal, developing an ability to make good moral judgments, is a lifelong process and must always take into account changing conditions, information, relationships, and personal growth. Thus, what will serve students best is not an attempt to lead them to preconceived answers, but rather to show them how to arrive at questions and possible answers. "Thinking well" demands an ability to account for a complex of contributing aspects, *both cognitive and affective*, in each moral situation. The program goal involves working on the ability to create an integrated perspective on an issue and recognizing the various dimensions needed for sound judgment. As an ending point, senior seminar does focus on critical thinking. The goals of the program lead to making sure seniors have adequate critical thinking skills before they go out into the world. (Nelson, 1986, p. 6)

The class stresses the need to teach students to think well about problems, resist easy solutions, and combine many separate resources and skills, both intellectual and personal

(Nelson, 1986). All of this is evidence that critical thinking is a learning goal for these two liberal arts institutions. Regardless of previous ability, students should graduate with the ability to think critically.

Of course liberal arts offers more than critical thinking as an "extra." There is the encounter with the cultural, artistic, and spiritual dimensions of life, there is understanding of the methods, principles, theories, and ways of achieving knowledge which are proper to the different intellectual realms. There is the realization of the ways all our lives are shaped by global as well as local, political, social, psychological, economic, environmental, and physical forces. Although critical thinking is not always separate from discipline-specific knowledge, it is what remains after facts have been forgotten or become outdated. It is what allows an individual to learn, to want to know more, and to take personal responsibility in all aspects of life.

Tim Griffin, the Director of Institutional Research and Assessment at the College of Saint Benedict and Saint John's University agrees. In an interview, he quoted Plato, "The unexamined life is not worth living." He said that colleges intervene for four years to produce people with character. He thinks that students should graduate with self awareness and the confidence to take new directions. College is about development and growth, but mostly about self assessment. In relation to self assessment is the integration of knowledge and the application of it. To be self directed learners, students must know who they are and how they learn. It involves doing the right thing at the right time (personal communication, April 5, 1997). Critical thinking is also about knowing procedures and when to apply them. It is about being proficient in applying skills and being willing to do so when appropriate. Reflecting on and improving one's critical thinking skills involves judging when one is or is not performing well, or as well as possible, and

considering ways of improving one's performance (Facione, 1996). Dr. Griffin says that enhancing critical thinking is very central to all else that the colleges seek to accomplish and enhance. At the College of Saint Benedict and Saint John's University, critical thinking is a central learning goal.

What the liberal arts promises is implicit, beautiful, phenomenal, and philosophical. Not only should all undergraduate students develop critical thinking skills and characteristics, but they should be measured because the measurement process can generate questions, and confirm or disprove some basic assumptions about what students are learning. Measurement can also tell us about how well faculty are teaching and most importantly, what students are learning. Finding out what students are learning and what they are taking with them beyond college are things that the measurement process can help to clarify. Although the institutions already measure GPA, which reflects classroom learning, we should also measure the extras that make a liberal arts education more appealing than technical training. Increased attention is being devoted to educational outcomes by members of the higher education community, boards of trustees, state legislators, and even judges in federal courts. Unless the outcomes of higher education can be clearly specified and documented by members of higher education community, then this community may lose critical financial and moral support or will be subjected to inappropriate and externally-imposed outcome measures (Chickering, 1977). It is important to locate the "value added" by the integrative environment of the institutions.

My personal belief is that we should not measure what goes on here to satisfy external mandates, we should measure what we do to maintain institutional integrity. Measurement allows for continual improvement. By knowing where we stand, we can make changes if and

when they are needed. If we find that we are doing well, we can document this and take pride in it. As our assessment efforts have refocused from teaching to learning, it becomes more important that we find out whether critical thinking improves while keeping in mind the limits and applicability of the measurement process. By measuring and studying the development of critical thinking skills and dispositions we should be able to have a better idea of whether or not graduates are adept at critical thinking, which is very central to the institutions' learning goals and is an important skill to have in the world. Assessment is not about conforming to standards, it is about clarifying whether or not students are meeting faculty standards.

As is usually the case, some people are apprehensive about the measurement process. Some people think that measurement takes away from the beauty of life. Others are afraid that the measurement process will not take all things into consideration or that major decisions will be made based on the measurement of human affairs. Some see measurement as a wasted effort, as not necessary, or are afraid of what the results might yield or how far the results can be generalized. There is the fear also that what we do will be reduced only to measurable outcomes or that we will stop growing as an institution. The contrary is true. To measure critical thinking at these institutions is only to know how critical thinking skills and dispositions vary among students, and provide an opportunity to improve student learning. Measurement helps to clarify whether students are "getting it" or not. In addition, such information is very helpful to such efforts as the Admissions efforts and others.

> It will be said that only the baser parts of education can be counted and weighed, and that finer consequences for the spirit of man will be lost in proportion as we try to measure them,- that the university will become a scholarship factory, turning out lawyers and doctors guaranteed to give satisfaction, but devoid of

> culture. This is part of the general fear that science and measurement, if applied to human affairs, the family, the state, education, and religion,- will deface the beauty of life, and corrode its nobility into a sordid materialism...the fear is groundless,...Man sees no less beauty in flowers now than before the day of quantitative botany. It does not reduce courage or endurance to measure them and trace their relations...If any virtue is worth seeking, we shall seek it more eagerly the more we know and measure it...Of science and measurement in education and elsewhere, we may safely accept the direct and practical benefits with no risk to idealism. (Thorndike, 1921, as cited in Joncich, 1968, pp. 282-283)

Measuring Critical Thinking

A number of tests have been created to measure critical thinking. Two of the newer instruments are the California Critical Thinking Skills Test (CCTST; Facione, 1992) and the California Critical Thinking Dispositions Inventory (CCTDI; Facione & Facione, 1992). Prior to the development of the CCTST and CCTDI, the two most commonly used standardized, objectively scored tests of critical thinking ability appropriate for high school and college individuals were the Watson-Glaser Critical Thinking Appraisal (Watson & Glaser, 1980) and the Cornell Critical Thinking Test (Level Z) (Ennis, Millman, & Tomko, 1985). The Enis-Weir Critical Thinking Essay Test (Ennis & Weir, 1985) is contemporary with these instruments, but requires the evaluation of constructed responses by raters who have completed at least a college-level course in informal logic, critical thinking, or the equivalent. The Watson-Glaser Critical Thinking Appraisal uses an older, much less robust concept of critical thinking than the California tests and does not address dispositional elements of critical thinking (Jacobs, 1995).

The Cornell Critical Thinking Test (Level Z) was originally designed to assess critical thinking competencies in order to evaluate the effectiveness of curricular and instructional

innovations. However, it only produces a total score. The Watson Glaser Critical Thinking Appraisal was a dependent variable in a major experiment designed to examine the effects of instructing high school students in critical thinking. The Watson Glaser is superior to the Cornell primarily because of the availability of equivalent forms, data concerning the technical characteristics, and the extensive normative data (Jacobs, 1995). The fairly new California tests possess great potential to prove superior to their contemporaries because they addresses the dispositional element of critical thinking (which formed the basis for the CCTDI), they attain a high level of content validity, and they utilize a multiple choice format.

The inclusion of the dispositional element is crucial. Measuring critical thinking is a difficult task given that we cannot test students in real world situations or follow them throughout life to make sure that they are using critical thinking in their lives. When measuring critical thinking in educational settings and for assessment purposes, experts suggest that tests users make sure that the definition of critical thinking adequately matches their idea of it (Facione, 1990). The California tests seem to match the learning goals of the College of Saint Benedict and Saint John's University as they relate to critical thinking because the dispositional element is measured. The tests are unique in addressing the dispositional element of critical thinking. Although the dispositional element is harder to measure reliably and validly, it remains an important component of critical thinking. It is the aspect of critical thinking that involves self reflective judgment and is also the aspect most likely to yield information regarding the likelihood that students will use what they have learned after college.

Critical thinking within the context of a liberal arts institution means more than the acquisition of cognitive skills. John Feare (1992) says that critical thinking is about self-

criticism and openness to criticism of one's own opinions and conduct, while listening to and evaluating all that is said against them. A holistic approach to critical thinking involves adherence to its essential practices of self criticism, which is the willingness to subject one's own biases and beliefs, however cherished, to scrutiny. Critical thinking is more than a sum of skills, it incorporates abilities, attitudes, and values that are essential to the process and primary purpose of critical thinking. Emotions help us to achieve both reasonableness and objectivity that are needed for critical thinking. If critical thinking skills are not complimented by such attitudes as fair-mindedness and empathy, then our proficiency in the skills of reasoning may simply make us more effective promoters of our own ego- and ethno-centrism (Feare, 1992). Attitudes, habits of mind, and character traits are all encouraged by the liberal arts in addition to the cognitive skills necessary for quality critical thinking, making these tests useful to liberal arts institutions. The dispositional element is useful in showing whether or not program outcomes have been achieved. Experts (delphi) agree that the dispositional element is crucial due to the self-criticism and self-correction that is an important in using critical thinking (Facione, 1990a). This researcher feels that the measurement of critical thinking at the College of Saint Benedict and Saint John's University demands the measurement of both the cognitive skills and the dispositional aspect of critical thinking.

The California tests maintained a high standard of content validity by using an agreement among 46 critical thinking experts to conceptualize critical thinking. This group communicated for two years using a qualitative research methodology known as the delphi method. Dr. Eugene Garver, the former holder of the McNeely chair of Critical Thinking at Saint John's University was a member of this group. They articulated a description of an ideal critical thinker in lower

division general education classes and the ideal first year student or sophomore in a general education program. They also agreed that the dispositional element is crucial due to a person's self examination and self correction (Facione, 1990a). This conceptualization of critical thinking by experts is a benchmark in critical thinking instrument development because it has never been done before. A good definition of critical thinking is a good step toward reliable and valid measures.

It is very difficult for people in general to agree on a definition of critical thinking. The learning goals at the College of Saint Benedict and Saint John's University use the term "clear thinking" rather than critical thinking for this very reason. The same types of things happen when trying to define critical thinking as happen when trying to define violence, for example, except it is worse. Is it good thinking, creative thinking, or something else? Is critical thinking dependent on content knowledge or separate from it? Certainly an agreement of experts is a good step toward a reliable and valid measure. For no other instrument has this been done. Typically in the past, test authors selected a definition they liked and then people who agreed with the definition for the most part use the instruments. The varying definitions of critical thinking allow people to define it as they please which can lead to difficulties in analyzing the evidence regarding critical thinking.

The California tests' inclusion of the dispositional element of critical thinking and their use of a conceptualization of critical thinking that was agreed upon by experts, as it relates to college-aged individuals, were two strong reasons this researcher chose to use these tests. They also utilize a multiple choice format which make them easy to use for assessment purposes. Completion of the California tests take about one hour to complete and they are intended for

learning outcomes assessment research for groups, not individuals, which makes them ideal for assessment purposes. The California tests are in the early stages of development and more research is needed to confirm that they are reliable and valid for assessment purposes.

Characteristics of the California Critical Thinking Dispositions Inventory (CCTDI)

The consensus by experts, using the Delphi method, yielded the following definition of critical thinking *dispositions*:

> The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit.
> (Facione & Facione, 1990, p. 2)

The Critical Spirit is a temperament, a set of attitudes, or personal disposition to prize the use of critical thinking in one's personal, professional, and civic affairs (Facione, 1990a). This test is not a measure of one's critical thinking ability. The definition was used to create the California Critical Thinking Dispositions Inventory and to formulate the subscales. The definition was used to generate a pool of 150 items that was subjected to analysis until a final group of 75 items, making up the CCTDI was found.

Two reliability studies of the CCTDI were conducted. One was with a group of 164 persons tested at two sites in the US and Canada. The second was with an independent sample of 156 persons that consisted of a mixture of post-baccalaureate, doctorate and high school students. Cronbach's alpha for the first group was .90 for the entire scale. For the second group it was .91.

The seven subscales were examined by the same indicator. The Cronbach alphas for the subscales for the first study ranged between .71 and .80. In the independent replication sample the sub-score alphas ranged between .60 and .78 (Facione,1992).

Due to the fact that there are not any other measures of critical thinking dispositions, it was impossible to correlate CCTDI scores with other measures (Facione & Facione, 1992). Furthermore, subscale scores and cutoff scores are based on a theoretical rationale, not on a norm group, so there is danger of misinterpretation. Based on a sample of 267 individuals from the United States and Canada, the mean score was 304, but no standard deviations were reported. Factor analyses of responses supported the existence of several common, but not necessarily discreet factors. Correspondence of the factors with the subscales was not reported. Predictive and convergent validity are unknown at this time. Users are warned to match items and program outcomes with the definition of critical thinking used and to clarify research questions prior to assessment (Facione & Facione, 1992). The authors chose to be true to the Delphi research which did not result in any sharp delineations between subscales. The content of the questions was reviewed by the Delphi Panel and reflected the Delphi Panel's conceptualization of critical thinking. In other words, the main goal of the test authors was to remain true to the recommendations of experts and they to continue work on the psychometric properties of the instrument as it develops. Users are also warned not to use the CCTDI for high stakes assessment. For example, to use scores to exempt a student from a requirement based scores on the CCTDI. Clearly, further validity testing is warranted.

Characteristics of the California Critical Thinking Skills Test

A consensus on the core elements of critical thinking *skills* reached after 46 theoreticians from various academic fields agreed were the following:

> ...the process of purposeful, self-regulatory judgment. At its core are cognitive skills of interpretation, analysis, inference, evaluation, and explanation. These skills are employed in the reflective, reasoning process. In critical thinking a person gives reasoned consideration to evidence, context, theories, methods and criteria in order to form a purposeful judgement. The expert consensus includes this metacognitive self-regulation as a core critical thinking skill (Facione, 1992, p.2).

The cognitive skills dimension of critical thinking seems to be an essential element of college education. The suggestions made by the Delphi research panel were then translated into a test with the total score and the subscale scores reflecting the experts' opinions.

Reliability

Based on a 35 item pilot, 1169 pre, post, control and experimental individuals were tested, providing 1673 tests for reliability analysis. Items were scored dichotomously (correct vs. incorrect answers). Kuder Richardson-20 alpha was computed separately by pretest and posttest for the 34 item instrument. The resulting alphas were .69 and .68 respectively which appear low, especially considering the number of items (Facione, 1992). An alpha of .80 is suggested when testing a single, homogeneous ability. However, when testing for a variety of abilities, low inter-item correlations are arguably sufficient. When testing a variety of skills thought to be part of critical thinking, they should correlate highly with one another. Norris and Ennis suggest alphas of .65-.75 as sufficient (Norris & Ennis, 1989). Nunally also says that dichotomously scored tests typically yield a low inter item correlation (as cited in Facione, 1992, p. 12).

Peter Facione (1989/1990b) pretested and posttested 1169 college students using the California Critical Thinking Skills Test at California State University, Fullerton, which is a

public, comprehensive university. This was the same group used for the reliability analysis. The participants averaged 22 years of age and were of at least junior standing. They were taking lower division, general education courses and a majority reported only being in the classes because they fulfilled general education requirements. He pre-tested 480 students in approved critical thinking courses and as a control he pre-tested 90 students in Introduction to Philosophy. Then he post tested an independent group of 465 different students in approved critical thinking courses and as a control post-tested 124 students in Introduction to Philosophy finishing the same courses that the first group was starting. When the first experimental group, enrolled in approved critical thinking courses, and control group, enrolled in Introduction to Philosophy, had completed with the courses, he also posttested them. For the experimental group (in critical thinking classes), significant differences between pre and post scores were found, but not for the control group (Introduction to Philosophy classes). For the experimental group, the effect size was about one third of a standard deviation.

Using this same sample of students, scores on the skills test were significantly correlated with other factors generally regarded as indicators of academic ability and success. CCTST pretest scores were significantly correlated with GPA (r=.20), SAT-verbal scores (r=.55), SAT-math scores (r=.44), and even more highly correlated with GRE scores (Facione, N., Personal Communication, March, 31,1997). They are also correlated significantly with semesters of high school preparatory English (r=.16), and the number of high school semesters of math (r=.10). Pretest scores were not significantly correlated with age, number of college units completed, critical thinking self-confidence, number of semesters of science, or gender (Facione, 1990c).

These results imply that critical thinking is not a naturally occurring by-product of a

college education and that critical thinking skills do not simply improve through the college years or as one gets older. Another implication of these findings is that critical thinking can be taught, learned, and objectively assessed because growth was measured in this situation. The present study takes this idea a step further by testing students in general education classes geared toward critical thinking, but not explicitly teaching it as a requirement and by testing students at various stages within their college careers. It is possible that critical thinking could be a by-product of a liberal arts as opposed to a public, comprehensive education. This could be because of small class sizes, a lot of group work, or a variety of other factors.

The correlation between scores on the CCTST and GPA (r=.20) seems low. Sometimes what happens in the classroom inhibits the acquisition of critical thinking skills (Facione, 1996). Sometimes students can get good grades at the expense of deeper, critical, analytic learning. According to Becker et. al. (1968), getting good grades is the key goal that organizes the classroom, grades reward success in academic achievement, and good grades demonstrate a student's ability to meet the demands of a collegiate environment. Sometimes, getting good grades becomes a paramount concern for students and critical thinking is sacrificed because it is irrelevant to and may jeopardize a good GPA. Becker (1968) conducted a two year participant observation study of Midwest college students. He found that students see their intelligence as separate from their GPA, but often still do whatever is necessary to obtain a good GPA. The perspective students sometimes take is to do what they must for the sake of grades often does not affect actual GPA. He found that college students today are accustomed to the presentation of problems and tasks out of context and tackle these assignments just because they are there (Gardner, 1983). Later, Randow et. al. (1988) further supported these conclusions, by surveying

137 UCLA undergraduates finding that students do not perceive GPA as representing all of their intellectual abilities, therefore, further supporting the existence of the "GPA perspective." The implications of this study are that the relationship between GPA and critical thinking skills is in need of clarification. The present study also aimed to clarify this issue with respect to two coordinate liberal arts institutions.

In 1993, Deborah Daiek tested the critical thinking ability of 59 high risk students with the California Critical Thinking Skills Test. She found that scores on the CCTST were predictive of first semester GPAs. In addition, she found that higher scores on the CCTST were correlated with higher ACT scores, in support of Facione's (1989/1990) study. One implication of Daiek's study was that critical thinking is vital if students are to become academically successful. The fact that students take an active role in learning is a part of critical thinking and that they work from an internal locus of control, suggests that may make them better learners. Because they are better learners they may tend to do better in college. They also tended to be more motivated. The present study also investigated the relationship between GPA and scores on the CCTST not at a public, comprehensive university in an at-risk program, but at a private institution. In addition, the present study correlated scores on the CCTDI with GPA.

Facione (1992) found significant, and rather high correlations between scores on the skills test and scores on the dispositions inventory with a sample size of 20 ($r = .67$). If the scores are significantly correlated, one wonders why participants should take both tests. Although both tests are face valid according to expert committees, the authors claim that scores on one predict scores on the other, causing this researcher to question their specificity. At the same time, the authors claim that the tests are unique. The present study uses a larger sample to examine the

relationship between the skills test and the dispositions inventory.

The department of nursing at the College of Saint Benedict has used the CCTST to assess critical thinking for nursing students when exiting as seniors and entering as juniors since 1993. Their national accrediting agency requires the assessment of critical thinking. They are also involved in a statewide study of critical thinking in baccalaureate nursing. Based on 301 students in the nursing program at the College of Saint Benedict, correlations between the CCTST and the CCTDI were not significant. This could be due to the restriction of range occurring because of the high qualifications for entry into the program. The average correlation was (r=.11). Thus, the evidence that the two tests are correlated is conflicting. The implications of the tests being significantly correlated could mean that someone with the skills is likely to use them. If the tests are not significantly correlated, this could mean that having the skills does not necessarily mean that one will use them. The issue needs to be clarified. The present study investigated this issue further with a larger sample with different ages. In addition, the present study tested students from many disciplines, not just one.

No subscore reliabilities for the CCTST have been provided. However, percentiles can be found in the test manual. Criteria for item retention and placing items in subscales was not presented. The subscales Analysis, Evaluation, and Inference on the CCTST were developed based on the Delphi panel's recommendations. However, the subscales Inductive Reasoning and Deductive Reasoning were included because of a California State University objective. These last two subscales are also based on 30 of the 34 items. Thus, there is a need for further validation and reliability studies of these potentially useful and important measures.

The Present Study: Further Validation of the CCTDI and CCTST

Research is in progress regarding the CCTST and the CCTDI, but more is needed. Rather than measuring gains in critical thinking from one approved critical thinking course, the present study focuses on the potential gain in critical thinking skills and dispositions throughout an undergraduate education at a liberal arts institution. This study does not set out to use a longitudinal design, but compares data from general education classes that first year students take versus classes that senior students take (Symposium vs. Senior Seminar). The correlation of GPA with scores on the skills test and the dispositions inventory at a liberal arts college is also investigated. GPA has not yet been correlated with critical thinking dispositions. Becker et. al. (1968) brought to light the fact that GPA might very well be independent of critical thinking so we should not automatically assume it is. He found that some students do not perceive GPA as including critical thinking. Even more interesting is the idea that when students concentrate only on grades and fulfilling requirements, this attitude often does not yield a high actual GPA. The issue needs further clarification. Since liberal arts colleges tend to have smaller classes, more small group work, and more one-on-one interaction with professors, it is likely students will gain critical thinking skills. Clarifying the relationship between critical thinking dispositions and skills is also a goal. The study will also provide evidence to validate the CCTST and CCTDI as tools for assessing critical thinking learning goals at colleges and universities.

As a liberal arts institution, the implications of assessing student are learning as a result of instruction are far-reaching. If students possess critical thinking dispositions, this implies they love learning. If students have the skills, this means that they have the tools to continue learning after college. Graduate schools, employers, individuals, and society appear to value critical

thinking. Since we do not rely on one class or person to teach or encourage critical thinking, there is no central place to turn to find out where the colleges stand. It is important to empirically determine the cumulative effect of the integrative environment offered in a liberal arts setting. If students gain critical thinking skills and dispositions here, the environment could be responsible in some way. Further clarification should follow. No matter what the results yield, it will be helpful for the future of critical thinking measurement at the College of Saint Benedict and Saint John's University and the improvement of teaching and learning. In relation to the tests themselves, establishing further their reliability, validity, and relation to GPA, by an independent researcher will be helpful to the validation process.

It is expected that scores on the CCTST and CCTDI will significantly differ for first year students versus senior students. Facione (1990b) found that critical thinking skills improved after an approved, general education critical thinking course. It is predicted that critical thinking skills and dispositions will improve after 4 years of general education as measured by the CCTDI and the CCTST. Even though there is no research on the CCTDI, it is expected that scores on the CCTDI will improve as well as scores on the CCTST. It is also expected that critical thinking skills and dispositions scores as measured by the CCTST and CCTDI will be significantly correlated with each other, even though Facione (1992) found a high correlation and Kathy Twohy (personal communication, April, 15, 1996) found a low correlation for nursing students. It is also expected that critical thinking skills as measured by the CCTST and dispositions as measured by the CCTDI will be significantly correlated with GPA, in support of Facione's (1990) validation studies.

Method

Participants

The initial pool of participants consisted of 402 undergraduates, with 36 protocols discarded because of failure to follow directions, leaving 366 in the final group. Most of the participants were in classes required of first year students and seniors as part of a core curriculum, and therefore are representative of the institutions. In addition, some participants were given extra credit in Introductory Psychology classes as an incentive. These classes fulfill graduation requirements for all students. One upper division management class also volunteered. Participants were invited to participate and were encouraged by their professors to participate, but all were volunteers. There were 216 first year students, 47 sophomores, 15 juniors, and 82 seniors with 6 not revealing class status. There were 202 females and 156 males with 8 not revealing sex. Ten percent of combined campus the population took the tests. The participants attended two private coordinate colleges in a rural area of the Midwest. One college is all female, while the other is an all male institution. They share a coordinate relationship in which there is a shared curriculum and administrative structure. Practically all classes are co-educational, while student development activities are both joint and separate. The colleges are Catholic affiliated and most students are Caucasian. The two campuses are five miles apart and there is a regular bus service to accommodate access to both campuses. The majority of these students attend college directly after high school and persist to graduate in 4 to 5 years, thus ages tended to range from 18-26 years, with most students being 18 to 21 years old.

Materials

The California Critical Thinking Dispositions Inventory (CCTDI; Facione & Facione,

1992) was designed for use at the college level and prompts participants to agree or disagree using a six-point Likert scale ranging from "strongly agree" to "strongly disagree." The 75 prompts use no technical vocabulary, require no college level content knowledge, and are phrased in English. They express familiar values, expectations, beliefs, perceptions, and opinions. Responses indicate the extent to which a person is favorably disposed toward such things as truth seeking, inquisitiveness, approaching problems systematically, and open-mindedness (Facione, 1992). The test produces a total score and scores for the subscales: truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, and inquisitiveness.

The California Critical Thinking Skills Test (CCTST; Facione, 1992) targets the cognitive skills dimension of critical thinking. The test is a standardized, 34 item, multiple choice test which targets those core critical thinking skills regarded to be essential elements in a college education. The test was originally intended for post-secondary level assessment. The items range from requiring an analysis of the meaning of a given sentence to those requiring much more complex integration of critical thinking skills. Some items require that the correct inference be drawn from a set of assumptions, some require that an inference which is provided be properly evaluated. Some require that the proper evaluation not only be determined, but also justified by the most cogent reason. Others require that objections to stated inferences be evaluated and that the evaluation of these objections be justified. No discipline-specific college level content knowledge is presumed. There is no technical vocabulary or critical thinking jargon and the contexts address topics that are familiar to college-aged individuals (Facione, 1992). The scale allows computation of several scores: Analysis, Interpretation, Evaluation, Inductive Reasoning, Deductive Reasoning, and Total Score.

A third section requested demographic and other information such as gender, area of major, year in school, confidence in answers, and confidence that GPA reflects critical thinking.

Permission slips were distributed to every participant with a code number in order that GPAs and scores could remain anonymous. It asked participants for their name, social security number, and PO Box, and then inquired if the participant had taken the tests previously. A signature indicated that the participant allowed his/her GPA to be obtained from school records.

Procedure

The tests were administered in the fall of 1996 to first year students and seniors during their regularly scheduled class periods and to introductory psychology laboratory students in a room arranged by the researcher. None of the participants were paid for participation, but psychology laboratory students received extra credit. Each participant was told he/she would be taking two tests related to thinking processes. It was necessary not to say the words "critical thinking" in order to be consistent with the instructions (Facione, 1992).

The participants were told that the first was a survey of their attitudes and opinions and the second was a timed skills test, which was like a regular classroom exam. They were told that they would receive their scores in the mail and that they would be fully debriefed at that time. The same procedure was followed for every section of students. All participants took the dispositions inventory first as instructed in the test manual. The test was not timed, but generally took about 15 minutes. Once everyone in a section had finished the dispositions inventory, all participants were told that they would be taking a timed, multiple choice skills test. Everyone waited until the researcher gave the instruction to begin and everyone was asked to stop after 45

minutes. Participants were only allowed to answer the demographic questions after the 45 minutes expired. Responses were recorded on machine readable forms.

Students were also asked to sign a consent form to allow the researcher to have access to GPAs through the registrar's office. All participants were told that they were not required to sign the consent forms. To ensure anonymity, names, social security numbers, signatures, and PO Boxes were only written on the permission slips. The test response sheets only had a random code number on them. The random code number on the scan sheet was matched with the code on the permission slip. The permission slips were handed over to the registrar's office and only GPAs paired with a random code numbers were returned to the researcher. The researcher went back to the registrar's office to pair scores with names and PO Boxes in order to return scores to students. Scores on both tests were later sent to all students along with an explanation of the experiment and more information about critical thinking in general.

Results

Reliability data for totals on both tests and their respective subscales are found in Table 1. All tests were conducted using an alpha level of .05. A one-way analysis of variance was conducted on the mean CCTDI scores, with year in school (first-year, sophomore, junior, senior) as the independent variable. The differences were statistically significant, $F(3,343) = 3.920$, $p = .009$. Means and standard deviations for total scores and subscale scores are found in Table 2. A one-way analysis of variance was also conducted on the mean CCTST scores, with year in school (first-year, sophomore, junior, senior) as the independent variable. The differences were statistically significant, $F(3,334) = 3.587$, $p = .014$. Effect size between first-year students and

seniors was about a half of a standard deviation. Means and standard deviations for total scores and subscale scores are shown in Table 3. The correlation between total scores on the CCTST and CCTDI was $r(N=331) = .257$, $p<01$. As scores on the CCTST increased so did scores on the CCTDI. The correlation between scores on the CCTST and GPA was $r(N=337) = .266$, $p<.01$. As scores on the CCTST increased so did GPA. The correlation between scores on the CCTDI and GPA was $r(N=349) = .178$, $p< .01$. As scores on the CCTDI increase, so does GPA. A majority (40%) of participants thought that most of their courses fostered critical thinking, while a majority (39%) also did not perceive GPA to be an accurate reflection of their logical thinking ability. A one-way analysis was conducted on CCTST total scores with gender. No significant differences were found on total CCTST scores between males and females. $F(1, 335)=.592$, $p < .05$. A one-way analysis of variance was also conducted on CCTDI scores with gender. No significant differences were found on total CCTDI scores between males and females. $F(1,344)=.197$, $p < .05$.

Discussion

Alpha reliabilities seemed low especially for the CCTST total (.60) and for the CCTST subscale, Analysis which was .13. The authors argue that on the CCTST a high alpha is not desirable since the test is not designed to measure one homogeneous skill, but a variety of skills. For the CCTDI there is no normative data, but the authors did obtain alphas between .71 and .80 for the CCTDI. Facione (1989/1990) obtained alphas in the range of .68-.70 and claims that Kuder-Richardson alphas of .65-.75 for this kind of a test are desirable, because the test is scored dichotomously and does not target one, homogeneous factor, but several different factors. This

study found a Kuder-Richardson alpha of .60 for the CCTST which is similar to past research. For the CCTDI, an alpha of .84 was found which is high. There is support for the reliability of the tests, but some issues still need to be resolved.

The results supported the hypothesis that dispositions toward critical thinking differ significantly between first-year students and senior students in the College of Saint Benedict's and Saint John's University's liberal arts environment. More importantly, the result supports the idea that students are likely to use their critical thinking skills in their lives. When students graduate they are more inclined to use critical thinking skills than when they arrived by increased scores on the CCTDI. The results showed that students also gain the cognitive skills necessary for critical thinking. This means that they give more consideration to evidence when they leave than when they started. They also use skills to monitor, correct, and improve the processes they are using to form judgements. Both results support the idea that these institutions are doing what they say they do and enhancing the lives of students, even though it is not yet explicit in showing that increased critical thinking skills and dispositions are caused by the environment offered by these institutions.

The significant, but moderate to low correlation between scores on the skills test and scores on the dispositions inventory lends some support to the quality of the tests for measurement purposes. In relation to the tests themselves, this is evidence that the cognitive skills and the dispositions that are both part of critical thinking are generally independent constructs with only about seven percent common or shared variance. They are two separate aspects of critical thinking that warrant separate measurement. Past research found a significant correlation ($r=.67$) with only a sample of 20. The present study found a much smaller correlation

which supports the instruments' specificity. There was also a significant, but moderate to low correlation between scores on the skills test and GPA. This means simply that GPA at the College of Saint Benedict and Saint John's University is related to critical thinking skills, but the relationship is relatively weak, which is consistent with earlier research. Scores on the CCTDI as related to GPA has not been studied in the past. The present study found a significant, but low correlation.

Peter Facione (1989/1990) found that scores on the CCTST significantly improved after one critical thinking class. The present study showed that critical thinking dispositions and skills improve throughout an undergraduate, liberal arts education. He also found critical thinking skills to be moderately correlated with GPA, testing participants from a public, comprehensive university as did Deborah Daiek (1993) with high risk students. This study is consistent with past research. This study found the same results with a larger sample indicating that Kathy Twohy's observations of the Nursing students' scores at the College of Saint Benedict may not be representative of a wider or general population, which could be a problem of restricted range due to the requirements to get into the Nursing program (personal communication, September 10, 1996). All of the results lend further support for the validity of the CCTST and the CCTDI.

These findings do imply that critical thinking can be a result of a liberal arts education. Facione (1990) found that students in Introduction to Philosophy did not improve in critical thinking, but students in approved critical thinking courses did. He also found that critical thinking did not improve with the number of credits acquired or the age of an individual. The present study compliments this finding and gives credence to the idea that perhaps the college experience enhances critical thinking. Rather than measuring only the improvement in critical

thinking due to one approved critical thinking class, the present study looked at the relationship between critical thinking and progression through general education. This implies that perhaps differences in critical thinking are not only found after one class, but may be a cumulative effect across a curriculum. Specifics could be studied in the future. The improvement found after one completed course in critical thinking was about one third of a standard deviation, while the improvement from four years of college education was closer to one-half of a standard deviation. In addition, the first-years students' scores from the College of Saint Benedict and Saint John's University were higher than the mean of students from a comprehensive, public university. It is true that students are not the same people when they are done with college as when they start.

One implication of Facione's (1989/1990) study was that if critical thinking is not explicitly taught then students don't learn it. After one approved critical thinking course, students improved their critical thinking skills. If this is true, then one implication for the present study is that we are teaching critical thinking and students are learning it. It is also possible that students are learning it despite the fact that it is not being taught. Facione (1989/1990) also found that improvement in critical thinking skills was not a function of age or the number of college semesters completed. Based on his research, this would further support the idea the maturation effect does not apply in this case but further support is needed. This also supports the idea that students must be taught and must learn critical thinking; it does not happen on its own.

Past research has found a moderate, but significant relationship between GPA and critical thinking skills at a public, comprehensive university. In addition, Deborah Daiek (1993) also found the same results with at risk students. Learning critical thinking skills significantly improved at risk students' GPAs. She speculated that preparation can also be a factor in GPA

and possibly critical thinking skills. Becker (1968) stated that students may not need to think critically to obtain good grades. The present study found a moderate to low, but significant relationship between GPA and scores on the CCTST and the CCTDI. This implies that at a liberal arts institution, GPA and critical thinking skills and critical thinking dispositions are related, but not the same thing. Implications of this finding are enormous.

GPA is a good indicator of how individual students are doing relative to each other, but we do not have yet a good measure to tell us how students in general (as groups) are doing and whether or not students are "getting it." The California tests were designed for this purpose. It makes sense that GPA and critical thinking skills are related because ACT scores have been correlated with both critical thinking skills and GPA. The fact that they are also different suggests that critical thinking is somehow different than general intelligence or obtaining grades even though better critical thinkers tend to do better on tests such as the GRE. The fact that dispositions also showed a significant, but low correlation with GPA brings up more issues. This correlation could be mediated by motivation. It would be hard to imagine someone who is not inquisitive, curious about the truth, and orderly in complex matters who does really well in college as measured by GPA.

Past research found a significant, but moderate correlation between scores on the skills test and scores on the dispositions inventory (Facione, 1990). Had the present study found a high correlation between the two tests, it would have suggested that the two tests measure the same construct. That is, students with good critical thinking skills tend to use them. However, the results indicate the skills and the dispositions to use those skills are fairly independent. In other words, those who acquire the cognitive skills necessary for critical thinking may or may not be

motivated to use them and vice versa. If someone does not have both the cognitive skills and the attitudinal desire to seek the truth, then it is likely he or she will not. This result could suggest that critical thinking training is a matter of both skills and attitudes. From personal experience, I think that once I got going on learning critical thinking, I developed a desire to seek the truth in all situations but this may not occur consistently for all students. Either dispositions and skills merely overlap or they are both a part of a larger construct of critical thinking. It seems logical for them to be related, and quite possible that the dispositional element might precede the acquisition of cognitive skills.

The present study does not reveal why critical thinking skills and dispositions improve throughout an undergraduate, liberal arts education. Facione (1990c) found that critical thinking skills were not related to age or college units/credits acquired. It seems that the increase in both skills and dispositions found at the College of Saint Benedict and Saint John's University could be attributed to small class sizes and the types of pedagogical techniques emphasized. There is also a lot of small group work or cooperative learning. It could also be the integrative and respectful environment or an accumulation of all things within this college environment that has such an effect on students. Something happens, we know not what. It could be the Symposium and Senior Seminar classes themselves. There is much future research that should be done in this area. To locate the specific cause of the gain in critical thinking and developing ways of improving instruction would make an excellent future research project at the College of Saint Benedict and Saint John's University.

All we know is that seniors scored higher in critical thinking skills and dispositions than first year students. Students manifest this improvement sometime while they are in college. We

also know that critical thinking dispositions and skills are related to GPA, but the nature of and the direction of the relationship is not clear. There is also a relationship between critical thinking skills and dispositions, but much remains to be clarified. However, past research also indicated a relationship between SAT scores, GRE scores, and critical thinking skills. This would support the idea that critical thinking is part of a larger construct of general intelligence. Future research could focus on what exactly scores on the CCTST can predict. The dispositional element of critical thinking could help to predict scores in other areas because it is the aspect of critical thinking indicative of whether or not students use the skills (Facione, N., personal communication, September 19, 1997). Its predictive value could be very useful to undergraduate institutions.

Another interesting finding of the present study was that this researcher noticed was that most students indicated that most of their classes fostered critical thinking, but did not perceive their GPAs as accurately reflecting their logical thinking ability. This lends further support to Becker's (1968) findings that students do what they must to get good grades. They perceive their abilities as separate from their GPAs. However, it is good to know that students do perceive their classes as fostering critical thinking. If the institutions would start to measure critical thinking on a regular basis like the institutions do GPA, there is the danger that students may look at it as something to be conquered in the classroom, but not in everyday life. If intrinsic motivation is related to critical thinking, it could diminish if measured on a regular basis.

Another interesting observation was that one Honors general education class of first-year students scored higher than any other class in the study on the CCTST. In addition, they had as a class the lowest standard deviation. According to Hass (1992), honors programs provide an

especially promising context in which to promote reflective judgment (p. 20). This is interesting because these students were first year students. This indicates that the relationship between GPA and critical thinking skills needs more research and clarification. Based on this mere observation, there is reason to believe that critical thinking skills could be related to general intelligence. However, a potential future research project could concentrate on how critical thinking skills, GPA, and general intelligence are different.

The present study has some noteworthy limitations. This study does not indicate where or when students are gaining critical thinking skills and dispositions. Behavior has multiple causes. The maturation effect and the attrition of less competent students could not be ruled out in this study. Even though the classes sampled are classes that, in principle, are to be encouraging such things, it has never been assessed in the past. One upper division management class participated because of its focus on critical thinking, but only scored average whereas an honors section scored above average. This researcher could have also had control group of individuals who had not been to college in order to isolate college education as the factor contributing to the increase in critical thinking skills and dispositions. This problem needs to be addressed by future research. Furthermore, even if it is assumed that the differences were the result of events in college, the source of these changes remains to be isolated.

Although a high level of content validity was maintained in the past, no criterion validity has been established. There is also no prior normative data. There remains the question of developing an ideal curriculum to encourage critical thinking and clarifying whether critical thinking is discipline-specific or transcendent across disciplines.

Of course there were logistical problems. Had this researcher started sooner, many more

students would have taken the tests. Many professors were cooperative and supportive of the project, but had already planned their entire semester. Future researchers should know that the professors are quite cooperative. The sample was basically a sample of a convenience due to the fact that there were no resources available to obtain a truly random sample of students. However, due to the classes of students that did participate, the sample is arguably representative. Since professors volunteered their entire classes, of course motivation could have affected the results. Students did receive their scores, but for no other reason would have been motivated to do their best other than the betterment of the institutions.

Another major problem with the data itself was that many students skipped the very last question from the demographic section added by this researcher. The last question asked students what their major or planned major was. There were only four categories to choose from. Many students did not know their intended major, did not know which category their major fell under, or did not know which major to choose if they had two majors. A good future research project would concentrate on comparisons between majors. This could reveal a lot in relation to which majors develop the kind of critical thinking that was articulated by experts.

One implication of the present results is that we should make our expectations about critical thinking explicit. Since so much ambiguity surrounds the construct of critical thinking, faculty at this institution should talk about what it means to them even if there cannot be agreement. Describing it is a beginning because you cannot assess what you don't know. Yes, it might be fine for everyone to teach what they think even if it does not correspond to anyone else's definition. However, then there are no standards, making measurement problematic. The first step is clarifying standards in order that students know what is expected and that faculty can

go back and see if students learned what they intended them to learn. It is necessary to know what to look for in senior students to know if they learned. This researcher would be happy if people started talking also about what GPA means and what it should reflect. It seems like we already include attitudes in considering grades being that participation in class is essential. In addition, what is expected from students based on a particular curriculum that faculty could create based on their assessment. A definition as a starting point would allow for constant revisitation and improvement. People should start talking and thinking and use this project as a starting point.

Suggestions for future research are numerous. There may be some connections of these tests with the Leadership initiative at the College of Saint Benedict and Saint John's University. One could compare the critical thinking skills and dispositions between majors. It would be interesting to see the difference between say Philosophy majors, English majors, Psychology majors, and Natural Science majors. It would also be interesting to compare different professors and their goals in teaching or to compare a professors' opinions of a student with objectively scored tests specific to critical thinking research. One area of future research that needs to be done is to correlate scores on the California tests with other measures of critical thinking. It would also be interesting to take all of the things inherent within critical thinking, such as internal locus of control and see which is most helpful for students. One could also compare student confidence and opinions about themselves with their actual abilities in critical thinking and GPA.

Faculty could be trained in methods to encourage students' critical thinking followed by student assessment to determine the impact. This would reveal the impact that faculty in

particular have on student learning. I have had assignments in which the only way I could complete them was to think critically. One could also compare this study with a study of transfer students and do some comparisons with other schools. There are many reliability issues that need to be resolved. Factor analysis or a regression analysis would reveal important information regarding the tests. Of course professors could measure the change in critical thinking within one class, however, there are more influences on a student's critical thinking than just one class. There are many more possibilities for future research.

Conclusion

Based on this study, we know it is possible to assess critical thinking skills and dispositions. I am also convinced that the lives of those with critical thinking skills are enhanced whether or not a person realizes that what they are using are critical thinking skills. As I know that many intangible benefits are gained in college, it is important to give them names and empirical support which is a difficult task. Specific differences in the lives of those with critical thinking skills is an area for future research. I have also realized that I am ultimately responsible for my own education, but there is a very integrative and rich environment here from which I can continually draw. This study did not focus on the factors that influence critical thinking, but only that students have them to a larger degree at the end than at the beginning of their college education.

Since critical thinking is important as it relates to an individual's life and future, more research on the topic should be done, especially in relation to measurement issues. Specific goals can be set to continue the talk about the measurement of critical thinking and to develop an

agreeable definition. It is a difficult task, but its difficulty does not lessen its importance. A liberal arts environment should produce well-rounded individuals, clarifying what this is and how it is accomplished in relation to critical thinking is crucial. Maybe I was lucky in having professors who emphasized critical thinking or maybe I was already tuned to respond to critical thinking. However, I don't know who to thank or what to support as the reason why I have become open minded and focused in inquiry. Not only do the institutions want to have an idea that what they do makes a difference, they should want to be sure about what students learn as that goal is the basis for all that is done in the college environment. Colleges can offer many things without ever knowing what students have gotten from them or whether or not the lives of students have been changed or enhanced. If the institutions offer more than learning facts, they should investigate to what extent students are "getting" those other things. They should find out if students are just sitting in class and completing assignments or if they are really thinking. Clarification through measurement helps everyone involved and should not be done simply to satisfy external mandates, but for the sake of improvement.

Acknowledgments

Most of all, I would like to thank Richard Wielkiewicz for encouraging me to do this project and for going out of his way to help me with it. I would like to thank Richard for being my mentor and for challenging me for the past three and a half years. He has gone above and beyond the call of duty as a professor.

I would like to thank all of the professors who allowed me to take up their class time to administer the tests.

I would like to thank Tim Robinson for being involved.

I would like to thank Laurie Wolfe for helping me administer the tests and Stephen Stelzner for giving Introductory Psychology lab students extra credit to complete the tests.

Kathy Twohy and Aubrey Immelman for being on my committee. I would also like to thank Kathy for allowing me to use the tests and for helping me out in various ways with the project.

My family who support me no matter what I choose to do.

My roommates for putting up with me.

I would also like to thank Eugene Garver who got be interested in critical thinking due to his phenomenal way of teaching.

All professors who go above and beyond the call of duty as professors and enhance the critical thinking ability of their students. It is the gift of a lifetime.

References

Assessment Plan, Learning Goals approved by Joint CSB/SJU faculty assembly 11/30/94, approved by FCAA 10/25/94.

Becker, H. S., Geer, B., Hughes, E. C., (1968). Making the grade: The academic side of college life. New York: Wiley.

Brown, P. C. Liberal education for leadership. (1994). Liberal Education, 44-48.

Callander, R. J. (1986). Liberal learning and the world: A banker's perspective. Liberal Education, 62, 1-7.

Chafee, J. (1992). Critical thinking skills: The cornerstone of developmental education. Journal of developmental education, 15, 2-8, 39.

Chickering, A. W. (1980). Liberal education and work. Phi Kappa Phi Journal, 22-23.

Conoly, J. C., Impara, J.,C., and Murphy, L. L. (1995). Mental Measurements Yearbook. Lincoln, Nebraska: University of Nebraska Press.

Core Curriculum Council, the College of Saint Benedict & Saint John's University (1987, July). Exploring the human condition.

Daiek, D. B. (1993). Effects of the California Critical Thinking Skills Test achievement on first semester success of Summer Academy students (Doctoral Dissertation, Wayne State University, 1993). UMI Dissertation Services, Ann Arbor, MI:

Ennis, R., Millman, J., and Tomko, T. (1985). *Manual, Cornell Critical Thinking Essay Test.* Pacific Grove, CA: Midwest Publications.

Ennis, R., and Weir, E. (1985). *Manual, the Ennis-Weir Critical Thinking Essay Test.* Pacific Grove, CA: Midwest Publications.

Facione, N. (Personal Communication, September 19, 1996).

Facione, N. (Personal Communication, March 31, 1997).

Facione, P. (1992). *Manual, The California Critical Thinking Skills Test.* Millbrae, CA: The California Academic Press.

Facione, P. A. (1990a). Executive summary: Critical Thinking: A Statement of Expert Consensus For Purposes of educational assessment and instruction. Research findings and recommendations of the Delphi report prepared for the American philosophical association. ERIC Doc. NO. ED 315 423, California Academic Press, Millbrae, CA, 1990.

Facione, P. A. Using the California Critical Thinking Skills Test in Research, Evaluation, and Assessment, ERIC Doc. No. ED 337 498, The California Academic Press, Millbrae, CA, 1991.

Facione, P. (1996). Critical thinking: What it is and why it counts. [On-line]. Available Internet: http://www.Calpress.com/critical.html. CA: California Academic Press. Accessed: 9/20/96.

Facione, P. A. Technical Report #1, Experimental validation and content validity, ERIC Doc. No. ED 327 549, The California Academic Press, 1990b.

Facione, P. A., Technical Report #2, Factors predictive of critical thinking skills, ERIC Doc. No. ED 327 550, The California Academic Press, Millbrae, CA, 1990c.

Facione, P., and Facione, N. (1992). *Manual, The California Critical Thinking Skills Inventory.* Millbrae, CA: The California Academic Press.

Feare, J. (1992). Forced to Think: The Title V Mandate in California. New Directions For

Community Colleges 77, 91-101.

Gardner, H. (1983). Frames of mind, New York: Basic Books

Ginsberg, E. (1976). The pluralistic economy of the U. S. Scientific American 235, 25-29.

Griffin, T. (Personal Communication, April 5, 1997).

Hass, P. (1992, Jan/Feb). Honors programs applying the reflective judgement model. Liberal Education 78, 20-23.

Jacobs, S. (1995). Technical Characteristics and Some Correlates of the California Critical Thinking Skills Test, Forms A and B. Research in Higher Education, 36, 89-108.

Joncich, G. (1968). The sane positivist. A biography of Edward L. Thorndike. Middletown, Conn.

Klemp, G. O. Jr. Three factors of success. *Vermilye, ed.*, Relating work and education, 102-109.

Naisbitt, John (1991). Megatrends 2000: Ten new directions for the 1990's. Avon, NY.

Nelson, J. L. (1986). Handbook for senior seminar professors.

Norris, S. P. & Ennis, R. H. (1989). Evaluating critical thinking. Pacific Grove, CA: Midwest Publications.

Novelli, L. Jr., Taylor, S. The context for leadership in the 21st-century organizations: a role for critical thinking. American Behavioral Scientist, 37, 139-148.

Rabow, J., Radcliffe-Vasile, S., Newcomb, M. D. & Hernandez, A. C. (1992). Teachers', students', and others' contributions to educational outcomes. Youth and Society, 24, 71-91.

Regelski, T. A. (1976, November). General education in a specialized world. Symposium on General Education., Fredonia, N. Y.

Twohy, K. (Personal Communication, September 10, 1996).

Twohy, K. (Personal Communication, April 15, 1996).

Watson, G., and Glaser, E. (1980). *Manual, Watson-Glaser Critical Thinking Appraisal, Forms A and B.* San Antonio: Psychological Corporation.

Table 1

Reliabilities based on a sample from a small, private institution

CCTDI	Alpha	CCTST	Alpha
TOTAL	.8365	TOTAL	.5995
SUBSCALES		SUBSCALES	
Analyticity	.6446	Analysis	.1285
Confidence	.8053	Evaluation	.4477
Inquisitiveness	.8050	Inference	.4053
Maturity	.6383	Inductive Reasoning	.4028
Open-Mindedness	.6633		
Systematicity	.7542	Deductive Reasoning	.5193
Truth Seeking	.6597		

Table 2.
Means and Standard Deviations of scores on the CCTST sorted by class standing.

	N	Mean	Standard Deviation
TOTAL			
First-Year Students	203	16.43	3.90
Sophomores	44	17.18	3.57
Juniors	15	17.13	3.93
Seniors	76	18.20	4.66
SUBSCALES			
Analysis			
First-Year Students	214	4.57	1.34
Sophomores	46	4.59	1.39
Juniors	15	4.47	1.19
Seniors	79	4.94	1.73
Evaluation			
First-Year Students	212	5.79	2.23
Sophomores	44	6.39	2.10
Juniors	15	6.27	2.37
Seniors	80	6.73	2.40
Inference			
First-Year Students	207	6.01	1.87
Sophomores	45	6.27	1.70
Juniors	15	6.40	1.59
Seniors	80	6.33	1.85

Deductive Reasoning			
First-Year Students	206	7.81	2.38
Sophomores	45	8.04	2.41
Juniors	15	7.73	2.15
Seniors	77	8.42	2.82
Inductive Reasoning			
First-Year Students	212	6.82	2.19
Sophomores	44	7.34	2.02
Juniors	15	7.60	2.13
Seniors	80	7.55	2.24

*Note: For the CCTST, the mean for a sample (N=781) was 15.89 for students who had not completed a college-level course in critical thinking. The sample was matriculated at a comprehensive, urban, state university. There are also percentiles based on this same sample in the test manual.

Table 3.

Means and Standard Deviations of scores on the CCTDI sorted by class status.

	N	Mean	Standard Deviation
TOTAL			
First-Year Students	210	297.60	30.26
Sophomores	46	310.97	26.47
Juniors	15	294.07	26.90
Seniors	76	307.43	33.15
SUBSCALES			
Truth-Seeking			
First-Year Students	212	35.27	5.45
Sophomores	46	37.14	6.11
Juniors	15	35.06	5.10
Seniors	79	37.46	6.11
Open-Mindedness			
First-Year Students	214	45.69	5.44
Sophomores	46	47.52	4.80
Juniors	15	44.61	5.28
Seniors	78	45.32	6.48
Analyticity			
First-Year Students	214	43.61	5.32
Sophomores	46	44.31	3.93
Juniors	15	44.48	4.51
Seniors	79	44.98	5.61

Systematicity			
First-Year Students	215	40.14	6.97
Sophomores	46	42.63	7.05
Juniors	15	41.03	6.59
Seniors	78	42.95	6.74
Confidence			
First-Year Students	216	43.11	6.60
Sophomores	46	44.44	6.68
Juniors	15	42.22	6.41
Seniors	82	44.84	6.50
Inquisitiveness			
First-Year Students	215	45.48	6.57
Sophomores	46	49.28	5.21
Juniors	15	43.87	8.15
Seniors	78	47.40	7.30
Maturity			
First-Year Students	213	44.31	6.03
Sophomores	46	45.65	6.41
Juniors	15	42.80	6.66
Seniors	79	44.89	6.85

*Note: Scoring of the CCTDI is based on a theoretical rationale. Answers depicting weak dispositions receive 1, 2, or 3 points per item, while answers depicting strong dispositions receive 4,5,or 6 points per item. A score below 40 on the subscales means that a person is weak in that disposition, while a score of 50 (target) or above means that one is strong in that disposition. A total score of 280 reveals a serious deficiency while a score of 350 reaveals a solid strength. The only information based on a sample of 267 was a mean of 304.